

## Carbogen gas for treatment of sudden deafness



### Clinical question

“Is carbogen gas effective in the treatment of idiopathic sudden sensorineural hearing loss?” Idiopathic sudden sensorineural hearing loss, also known as “sudden deafness”, involves an abrupt, usually unilateral, partial or complete loss of hearing. For most patients, there is no factor known to account for the deafness and no consensus about the most effective treatment. Patients with this condition may recover spontaneously, although this is difficult to predict in individual cases. For a number of years, some staff at Monash Medical Centre treated sudden deafness with carbogen gas (5% carbon dioxide and 95% oxygen), which was thought to improve oxygenation of tissues in the inner ear. The treatment appears safe, although its safety is poorly substantiated in the literature. It involves long inpatient stays, and considerable time, resources and inconvenience. The head of the ENT department requested assessment of the evidence of the clinical effectiveness of carbogen gas for idiopathic sudden sensorineural hearing loss.



### Search question

The request concerned all patients with idiopathic sudden sensorineural hearing loss. The intervention of interest was carbogen gas (defined as 5% carbon dioxide and 95% oxygen) inhalation therapy. The ideal study design to answer this question would be a controlled trial with patients randomised to receive carbogen gas or placebo (eg, inhaled air).



### Search

We searched online databases, including *Cochrane Library*, *Best Evidence*, *MEDLINE*, *Current Contents* and guideline websites. Our search strategy included the terms “hearing loss”, “sudden deafness”, “carbogen” and “oxygen inhalation therapy”. We identified three comparative studies published in English, one with concurrent controls and two with historical controls. More specific details are given in the complete report available at: <http://www.med.monash.edu.au/healthservices/cce/evidence/pdf/c/486.pdf>.



### Summary of findings

Edamatsu et al compared carbogen therapy in addition to standard care ( $n = 51$ ) with standard care alone ( $n = 35$ ),<sup>1</sup> which, in this case, comprised intravenous adenosine triphosphate disodium (ATP-2Na), vitamins B<sub>1</sub>, B<sub>6</sub>, B<sub>12</sub>, and C, stellate ganglion block, peroral steroids, cycloclandate and kallidinogenase. However, there is little consensus

among ENT specialists about what constitutes “standard care”. The other two studies, by Rahko and Kotti<sup>2</sup> and Kallinen et al,<sup>3</sup> compared carbogen to anticoagulation therapy. The comparison treatments used in these studies are not ideal — their effectiveness has not been demonstrated, and in some cases they may be harmful. The main outcome of all studies was hearing improvement, measured by conventional audiograms and speech audiometry.

► Edamatsu et al<sup>1</sup> reported a mean (SD) hearing improvement in the “carbogen gas inhalation” group of 21.4 (21.4) dB compared with 20.4 (19.0) dB in the “standard care” group. This was not a statistically significant difference ( $P > 0.05$ ). For reference, a 20 dB improvement is similar to the difference between faint background noise in a library (say, 40 dB) and normal conversational speech (say, 60 dB).

► Rahko and Kotti<sup>2</sup> found no statistically significant differences in mean pure-tone thresholds between treatment groups receiving “carbogen inhalation” ( $n = 44$ ) and “heparin infusion” ( $n = 43$ ) at baseline, after five days, or after one month.

► Kallinen et al<sup>3</sup> divided subjects into three groups: those who had difficulty hearing low ( $n = 41$ ), flat ( $n = 87$ ) or high ( $n = 40$ ) tones. Anticoagulation therapy appeared more effective for patients with difficulty hearing low tones, while carbogen gas inhalation appeared more effective than anticoagulation for patients with difficulty hearing flat and high-pitched tones. None of these reported differences were quantitatively large and none were tested statistically.

Each of the three studies had methodological problems. None used randomised allocation to ensure that the intervention and control groups contained an even distribution of potential prognostic factors. The intervention and control groups in the study by Kallinen et al<sup>3</sup> were different in ways that went beyond the treatment of interest. The anticoagulation group also received oral betahistine hydrochloride, while the carbogen group did not. Two of the studies used historical control groups,<sup>1,2</sup> which further increased the likelihood of variation in treatment. It is not clear whether, in the study by Kallinen et al,<sup>3</sup> the subject groups were created before or after the study, raising the possibility of an inappropriate post-hoc analysis in the latter case.

Interpretation of this kind of research evidence is difficult, as it is not possible to account for a large number of potential biases. Nevertheless, it has been known for almost 20 years that non-randomised trials produce much larger estimates of treatment effects than randomised trials.<sup>4</sup> Given the small treatment effects reported in these three studies, it is reasonably safe to conclude that carbogen gas inhalation is no more effective than heparin or “standard care” in patients with idiopathic sudden sensorineural hearing loss.



**Outcome**

This evidence report was presented at a journal club in the ENT department. As a result the department has discontinued use of carbogen gas inhalation therapy for patients presenting with idiopathic sudden sensorineural hearing loss. The hospital and clinicians will review further evidence as it becomes available.

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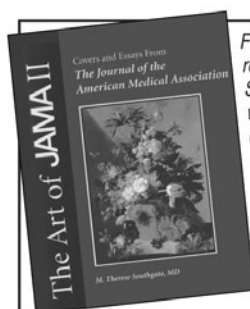
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**References**

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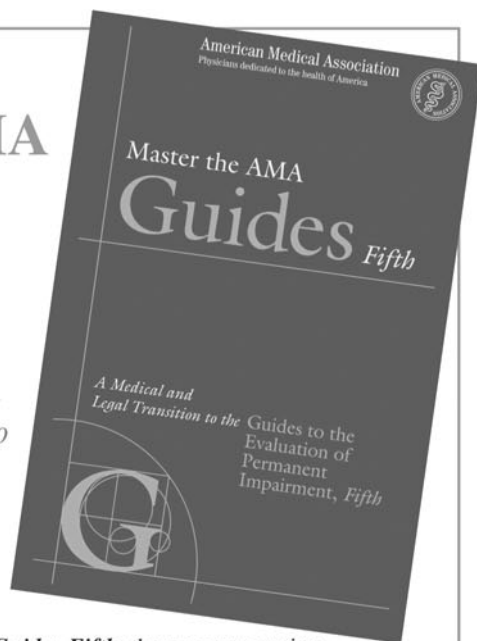
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